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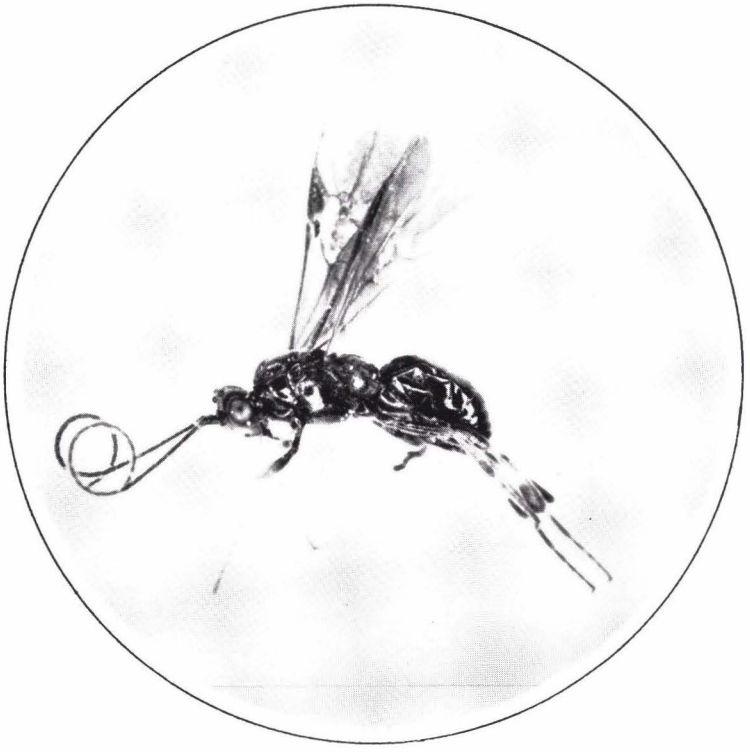
establishment and distribution of the LARCH CASEBEARER PARASITE

Agathis Pumila

in
Idaho, Montana,
Washington, Oregon and
British Columbia



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USDA - FOREST SERVICE - NORTHERN REGION
Division of State and Private Forestry
Missoula, Mt. 59801
REPORT NO. 74-3
AUGUST 1974

ESTABLISHMENT AND DISTRIBUTION OF THE LARCH CASEBEARER PARASITE, *AGATHIS PUMILA* (RATZ.), IN IDAHO, MONTANA, WASHINGTON, OREGON, AND BRITISH COLUMBIA

by

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The larch casebearer, *Coleophora laricella* (Hbn.), was initially discovered in the western United States near St. Maries, Idaho, in 1957. This insect, indigenous to Europe, was recorded in the eastern United States in the 1880's, but was not known to be west of St. Paul, Minnesota, until the Idaho discovery (Denton 1958). It has since spread over half of the natural range of western larch, *Larix occidentalis* Nuttall, (Fig. 1) and has caused considerable damage since its invasion in western larch stands (Tunnock 1969).

Biological control efforts were started in 1960 when *Agathis pumila* (Ratz.) was introduced in Idaho. *A. pumila* is considered a host specific parasite of the larch casebearer and native to Europe. It was selected because of its success in controlling the casebearer in eastern United States (Denton 1972). The infestation had already covered several thousand square miles when *A. pumila* was initially released. Importation of *A. pumila* was again accomplished in 1964 and 1965 to establish colonies for mass release programs.

METHODS

The initial releases in 1960, 1964, and 1965 were accomplished by importing live adults and by rearing parasitized larch casebearer larvae to obtain *A. pumila* adults for release.

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RANGE OF LARCH

EXTENT OF CASEBEARER

FIG.-1

Subsequent releases starting in 1966 were accomplished by obtaining the progeny from the imported source and distributing them throughout the infestation. This method consisted of attaching branches containing parasitized larch casebearer larvae to other larch trees at release sites while the larch casebearer was in the dormant stage in early spring (Terrell 1966).

This program continued annually from 1966 through 1969 except for one adult release in Oregon and one in Washington in 1971. At that time a total of 378 attempts to establish *A. pumila* had been made in the four-State area (Fig. 2) (Appendix).

Evaluations of release sites to determine if establishment was successful were started in 1967 (Tunnock and Bousfield 1969). Initially, evaluations consisted of dissecting overwintering larvae to determine if the *A. pumila* was present. Beginning in 1969 late instar larvae were collected and reared for parasites. The latter method proved to be more reliable since there was a chance of incorrect larval identification from native parasites.

The criterion for successful establishment was the recovery of *A. pumila* and not its abundance at a particular release site.

RESULTS AND DISCUSSION

Releases of *A. pumila* adults proved to be more successful than the "branch method," although the latter was more economical to administer. Timing the release to coincide with favorable instar development was critical when adults were released. The one failure in 1964 adult release occurred at a much higher elevation and suitable host material may not have been available, or the adults were held too long after emerging to successfully parasitize the casebearers.

Establishing parasites by placing infested larch branches when *A. pumila* is in the pupal stage has proven successful and may be the most desirable method to establish areas not accessible in early spring. This also eliminates mortality from competition in early spring if release site larch casebearer populations are high.

Adult releases in 1960 were 100 percent successful in becoming established (Denton 1972) and in 1964, 87.5 percent were established. Releases made in 1966 and 1967 by the branch method were 53.6 and 54.3 percent successful respectively, whereas in 1968 only 20 percent were determined established. Releases attempted in 1969 were 35.0 percent established, although only three generations have passed and our sampling technique may not be sensitive to detect small populations of *A. pumila* (Table 1).

Table 1.--*Agathis pumila* releases and their successful establishment

Year	State	Number releases	Number sampled	Number established	Percent successful
1960	Idaho	5	5	5	a/ 100.0
1964	Idaho	5	5	5	
	Montana	3	3	2	
		8	8	7	a/ 87.5
1965	Idaho	1	1	1	a/ 100.0
1966	Idaho	25	25	14	
	Montana	11	11	6	
	Washington	11	5	2	
		47	41	22	b/ 53.6
1967	Idaho	38	22	13	
	Montana	52	21	9	
	Washington	8	3	3	
		98	46	25	b/ 54.3
1968	Idaho	8	7	3	
	Montana	102	21	2	
	Washington	5	2	1	
		115	30	6	b/ 20.0
1969	Idaho	18	14	2	
	Montana	49	13	7	
	Washington	35	11	3	
	British Columbia	2	2	2	
		104	40	14	b/ 35.0
1971	Washington	1	1	0	
	Oregon	1	1	1	
		2	2	1	a/ 50.0
	Total	380	173	81	46.8

a/ Adult releases
b/ "Branch method"

Many release sites could not be further evaluated because larch casebearer populations were at extremely low levels. It is doubtful that some are established because of the absence of the casebearer in the area.

A. pumila seems to be more numerous at some release sites than in others of the same year. No explanation can be given for this difference. *A. pumila* parasitism has built up to 60-80 percent at some of the early release sites, whereas many parasitize less than 1 percent of the larch casebearer population. It is unknown at this time when *A. pumila* will be completely distributed throughout the infestation. As of this date limited dispersal has occurred from release sites, although it has been recovered from four areas more than a mile from known release sites (Bousfield 1973).

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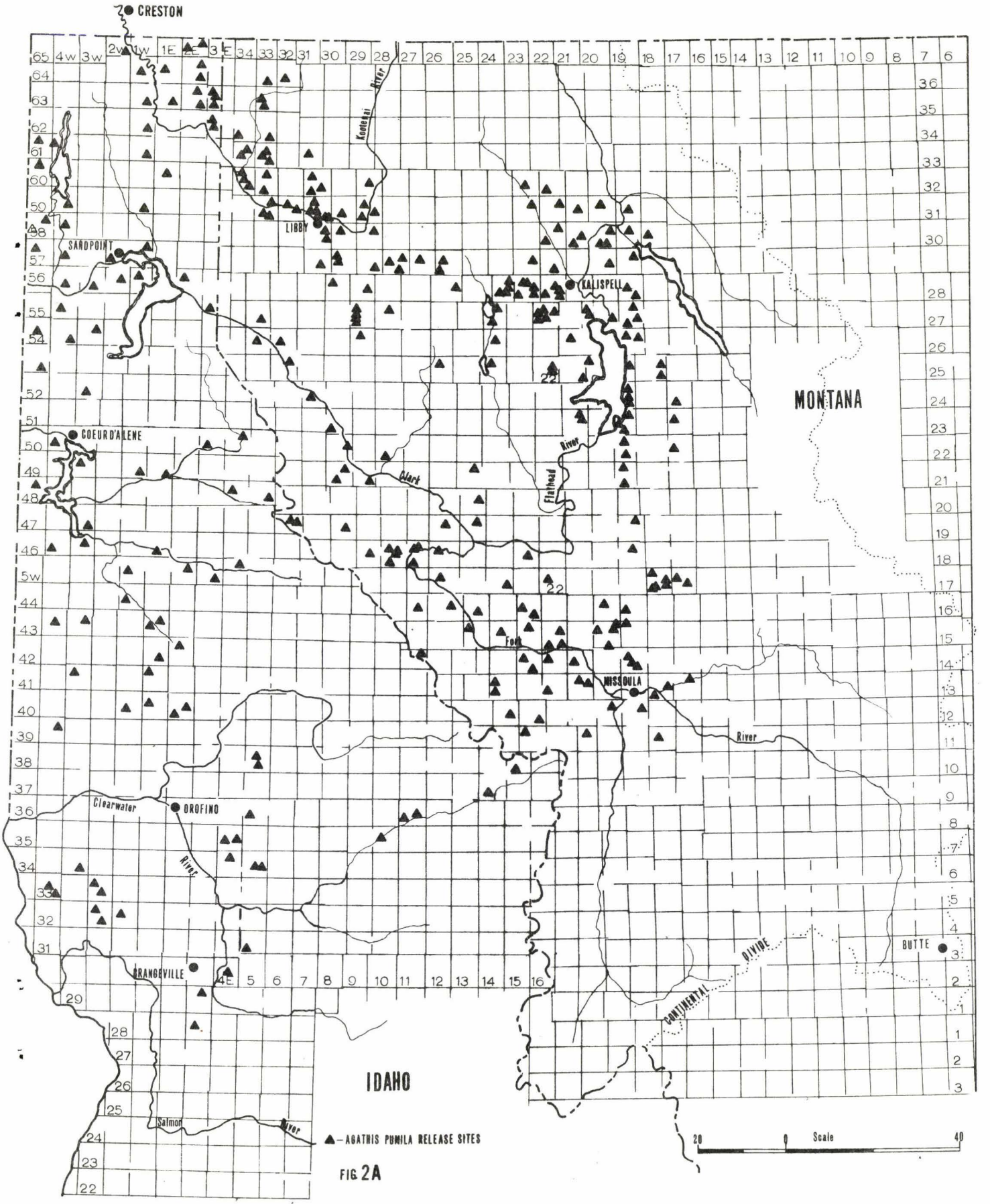
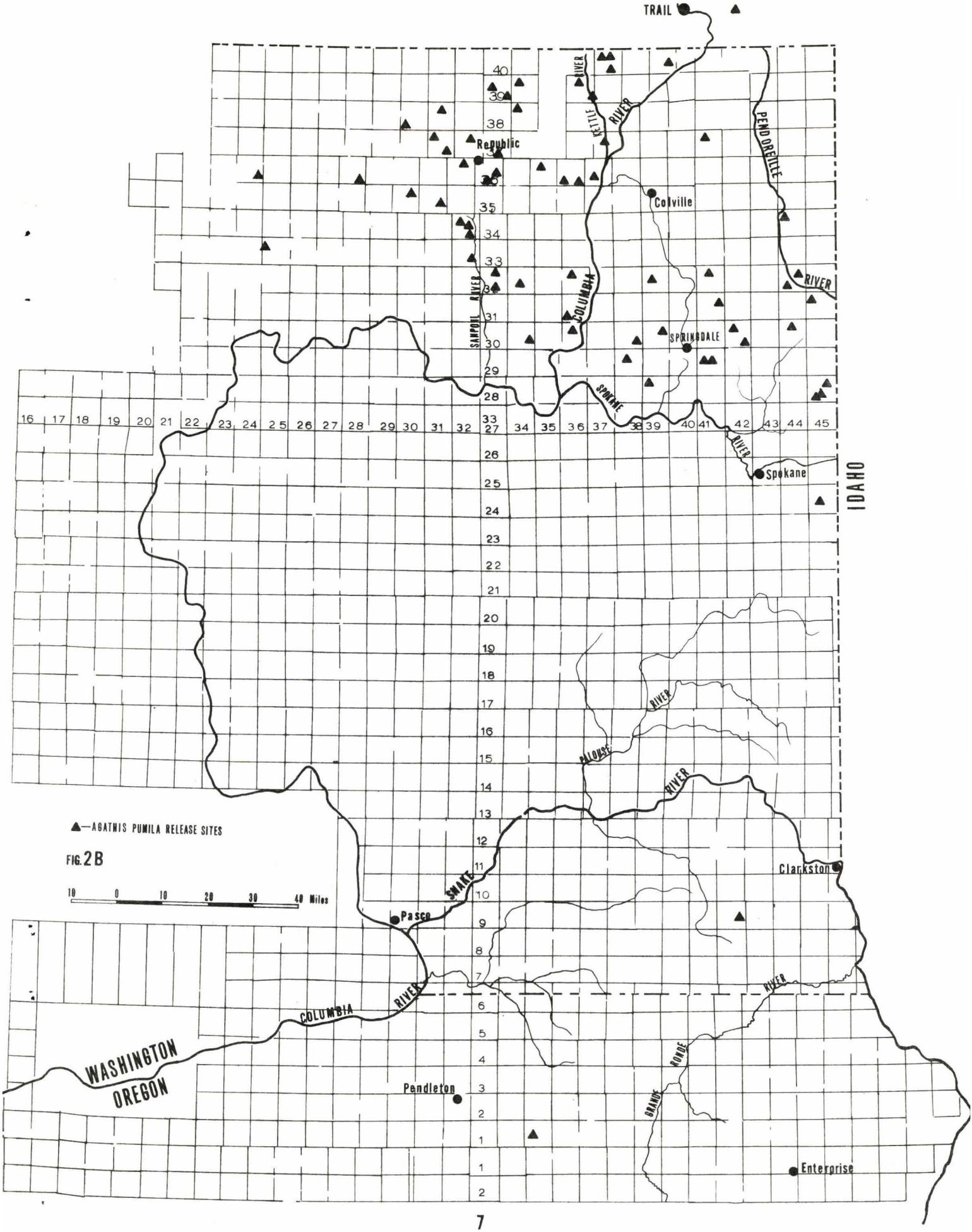

CRESTON
SANDPOINT
LIBBY
KALISPELL
COEUR D'ALENE
MISSOULA
OROFINO
ORANGEVILLE
BUTTE
MONTANA
IDAHO
Kootenai River
Clark Fork River
Flathead River
Clearwater River
Salmon River
CONTINENTAL DIVIDE
▲ – AGATHIS PUMILA RELEASE SITES
Scale
20
0
40

FIG. 2A


TRAIL
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Spokane
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Pasco
Pendleton
Enterprise
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PEND OREILLE RIVER
SANPOIL RIVER
COLUMBIA
SPOKANE RIVER
ALOUSE RIVER
SNAKE RIVER
COLUMBIA RIVER
GRANDE RONDE RIVER
WASHINGTON
OREGON
IDAHO
▲—AGATHIS PUMILA RELEASE SITES
10 0 10 20 30 40 Miles

FIG. 2B

APPENDIX

IDAHO

Agathis pumila release sites							Recovery information			
Year of release	* T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1960	47	3W	36	Indian Mountain		Adult	1968	Dissection	Yes	66.0
							1970	Rearing	Yes	63.0
1960	46	3W	10	Hayburn State Park		Adult	1968	Dissection	Yes	16.0
							1970	Rearing	Yes	41.7
1960	46	1E	29	St. Joe City		Adult				
1960	45	2E	11	Calder		Adult	1968	Dissection	No	
							1970	Rearing	No	
1960	45	1W	18	Thorn Cr.		Adult	1968	Dissection	Yes	2.0
							1970	Rearing	Yes	0.3
1964	57	2W	21	Sandpoint R. Station	I-3	Adult	1967	Dissection	Yes	85.0
1964	56	2E	18	Hope	I-1	Adult	1967	Dissection	Yes	25.0
							1970	Rearing	Yes	40.3
							1971	Rearing		
1964	55	3E	18-19	Clark Fork	I-2	Adult	1968	Dissection	Yes	16.0
							1971	Rearing		
1964	54	4W	36	Sheep Spring Creek	I-4	Adult	1967	Dissection	Yes	4.0
1965	58	5W	28	Falls N. Priest River	I-3A	Adult	1966	Dissection	Yes	
							1968	Dissection	No	

*All townships are north.

IDAHO

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1966	62	1W	25	W. Bonners Ferry	I-8	Branch	1968	Dissection	No	
							1970	Rearing	No	
1966	61	1W	36	Deep Creek	I-7	Branch	1967	Dissection	No	
							1968	Dissection		
							1970	Rearing	Yes	13.3
1966	59	1W	35	Grouse Creek	I-6	Branch	1967	Dissection	Yes	5.0
							1968	Dissection	No	
1966	57	4W	16	Blue Lake	I-9	Branch	1968	Dissection	Yes	2.0
								Rearing	Yes	6.3
1966	57	1W	2	Oden	I-5	Branch	1967	Dissection	Yes	1.0
							1968	Dissection	Yes	36.0
							1970	Rearing	Yes	31.7
							1971	Rearing	Yes	
1966	56	4W	33	East of Priest River	I-10	Branch	1968	Dissection	Yes	2.0
1966	56	3W	27	Dufort Road	I-16	Branch	1968	Dissection	Yes	1.0
1966	56	2W	23	Sagle Shepherd Lake Rd.	I-15	Branch	1967	Dissection	No	
							1968	Dissection	No	
1966	56	1W	16	Garfield Bay	I-17	Branch	1968	Dissection	Yes	1.0
1966	55	4W	29	Edgemer Curtis Cr.	I-11	Branch	1968	Dissection	No	

IDAHO

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1966	54	5W	28	Blanchard	I-12	Branch	1967	Dissection		
							1968	Dissection		
1966	54	3W	13	Careywood	I-14	Branch	1968	Dissection	Yes	7.0
1966	53	5W	36	Twin Lakes	I-13	Branch	1967	Dissection	No	
							1968	Dissection	No	
1966	52	3W	34	Hayden Lake	I-25	Branch	1968	Dissection	No	
							1970	Rearing	No	
1966	50	4W	29	Mica Cougar Creek	I-26	Branch	1967	Dissection	No	
							1968	Dissection	No	
							1970	Rearing	Yes	0.7
1966	50	3E	30	Steamboat Creek	I-21	Branch	1968	Dissection	Yes	1.0
1966	50	4E	10	Shoshone Work Center	I-20	Branch	1968	Dissection	No	
							1970	Rearing	No	
1966	49	3W	9	Eddyville Beauty Bay	I-24	Branch	1968	Dissection	Yes	1.0
							1970	Rearing	Yes	4.3
1966	49	1W	25	Rose Lake	I-23	Branch	1968	Dissection	No	
							1970	Rearing	Yes	4.0
1966	49	1E	35	Kingston	I-22	Branch	1967	Dissection	Yes	0.5
							1968	Dissection	No	

IDAHO

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1966	48	5W	11	Rockford Cr. Cd'A.Lake	I-28	Branch	1967	Dissection	No	
							1968	Dissection	No	
1966	48	4E	20	Osburn	I-19	Branch	1967	Dissection	Yes	0.5
							1968	Dissection	No	
1966	48	5E	35	Mullan	I-18	Branch	1968	Dissection	No	
1966	45	4E	11	Hoyt	I-27	Branch	1968	Dissection	No	
							1970	Rearing	No	
1966	40	2E	24	Elk River	I-29	Branch	1968	Dissection	No	
1967	65	2W	36	Porthill	I-95	Branch				
1967	65	2E	30	Danquist Trail	I-1	Branch				
1967	64	1W	27	Fisher Creek	I-96	Branch				
1967	64	1E	16	Brush Lake	I-98	Branch	1970	Rearing	Yes	0.7
1967	64	2E	2	Addie	I-2	Branch	1970	Rearing	No	
1967	63	1W	24	Ball Creek	I-97	Branch				
1967	63	1E	27	Three Mile Junction	I-99	Branch				

IDAHO

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1967	63	2E	11	Meadow Creek	I-3	Branch	1968	Dissection	No	
							1970	Rearing	Yes	0.3
1967	61	5W	3	Nordman	I-92	Branch	1970	Rearing	Yes	1.0
1967	61	4W	19	Reeder Bay	I-93	Branch	1970	Rearing	No	
1967	60	5W	2	Priest Lake	I-91	Branch				
1967	60	1E	16	Trail Creek	I-100	Branch	1968	Dissection	Yes	4.0
							1970	Rearing	Yes	1.0
1967	59	4W	15	Coolin	I-90	Branch				
1967	58	5W	12	Gleason McAbee Rd.	I-88	Branch	1970	Rearing	Yes	1.0
1967	58	4W	22	Priest R. Exp. Forest	I-89	Branch	1968	Dissection	Yes	1.0
							1970	Rearing	No	
1967	57	5W	8	Lower West Branch	I-87	Branch				
1967	46	5W	30	Plummer	I-77	Branch	1970	Rearing	No	
1967	45	3E	25	Marble Creek	I-60	Branch	1970	Rearing	No	
1967	44	1W	17	Santa	I-72	Branch				
1967	43	4W	20	Tensed	I-76	Branch	1970	Rearing	Yes	0.3

IDAHO

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1967	43	3W	13	Emida Vista	I-75	Branch	1970	Rearing	No	
1967	43	1E	7	Fernwood	I-71	Branch	1970	Rearing	No	
1967	43	1E	10	Olson Cr. by Fernwood	I-65	Branch	1968	Dissection	No	
1967	42	2E	5	Clarkia	I-64	Branch	1970	Rearing	Yes	5.6
1967	42	1E	23	South of Clarkia	I-70	Branch				
1967	41	3W	8	Harvard	I-73	Branch	1968	Dissection	No	
1967	41	1E	6	North of Boville	I-69	Branch	1968	Dissection	Yes	14.0
1967	40	1W	21	Helmer	I-68	Branch				
1967	40	1E	18	South of Boville	I-66	Branch				
1967	40	2E	32	Cameron Creek	I-67	Branch				
1967	39	4W	12	Troy	I-74	Branch				
1967	38	5E	22	Headquarters	I-56	Branch	1970	Rearing	Yes	0.3
1967	38	5E	35	Cardiff	I-55	Branch	1970	Rearing	Yes	3.3
1967	36	5E	16 or 17	Theodore Forest	I-53	Branch	1970	Rearing	Yes	4.3

IDAHO

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1967	36	11E	14	Packbridge	I-46	Branch	1970	Rearing	Yes	5.0
1967	35	4E	17	Greer to Weippe	I-52	Branch				
1967	35	4E	13	Weippe	I-50	Branch	1968	Dissection	No	
1967	34	4E	3	South of Weippe	I-51	Branch				
1968	65	2E	15	Moyie R. Road	I-105	Branch	1970	Rearing	Yes	2.0
							1971	Rearing	Yes	
1968	64	2E	26	Twin Bridges	I-104	Branch	1970	Rearing	No	
							1971	Rearing	No	
1968	63	2E	36	Deer Cr.Canuck Cr.Rd.	I-100	Branch	1970	Rearing	No	
							1971	Rearing	Yes	
1968	63	3E	18	Placer Creek	I-103	Branch	1970	Rearing	No	
							1971	Rearing	No	
1968	63	3E	21	Skin Creek	I-102	Branch				
1968	63	3E	32	Perkins Lake	I-101	Branch	1970	Rearing	Yes	1.0
1968	62	3E	8	Bonner Lake	I-99	Branch	1970	Rearing	No	
							1971	Rearing	No	
1968	62	3E	21	Herman Lake	I-98	Branch	1971	Rearing	No	

IDAHO

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1969	38	15E	32	Lolo Pass	I-18	Branch				
1969	37	14E	28	Powell	I-17	Branch				
1969	36	11E	30	Near Pack Bridge	I-16	Branch	1972	Rearing	Yes	
1969	35	10E	9	Near Green Flat	I-13	Branch				
1969	34	3W	25	Winchester #1	I-10	Branch	1972	Rearing	Yes	
1969	34	5E	25	Kamiah #1	I-14	Branch	1972	Rearing	No	
1969	34	5E	26	Kamiah #2	I-15	Branch	1972	Rearing	No	
1969	33	4W	23	Waha Lake #1	I-6	Branch	1972	Rearing	No	
1969	33	4W	36	Waha Lake #2	I-5	Branch	1972	Rearing	No	
1969	33	2W	8	Near Winchester	I-9	Branch	1972	Rearing	No	
1969	33	2W	15	Craigmont	I-8	Branch	1972	Rearing	No	
1969	32	2W	8	Winchester #2	I-7	Branch	1972	Rearing	No	
1969	32	2W	27	Craigmont West Lake	I-4	Branch	1972	Rearing	No	
1969	32	2W	20	Craigmont	I-3	Branch	1972	Rearing	No	

IDAHO

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1969	29	3E	4	Grangeville	I-2	Branch	1972	Rearing	No	
1969	31	5E	31	Harpster	I-12	Branch	1972	Rearing	No	
1969	30	4E	26	Lightning Cr. Area	I-11	Branch	1972	Rearing	No	
1969	28	3E	19	White Bird	I-1	Branch				

MONTANA

Agathis pumila release sites							Recovery information			
Year of release	T.	* R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1964-65	26	32	28	Rock Creek	M-1	Adult	1967	Dissection	Yes	90.0
							1970	Rearing	Yes	20.3
1964	25	32	3-10	McKay Creek	M-2	Adult	1967	Dissection	Yes	20.0
							1968	Dissection	Yes	60.0
1964-65	19	32	3	Hanaker Creek	M-3	Adult	1968	Dissection	No	
1966	27	29	19	Miller Cr. Fisher Rd.	M-5	Branch	1968	Dissection	Yes	34.0
							1970	Rearing	Yes	5.3
1966	27	3	26	Bull River Rd.	M-6	Branch	1968	Dissection	Yes	22.0
							1970	Rearing	Yes	34.7
1966	26	33	24-25	Noxon R. S.	M-7	Branch	1968	Dissection	No	
1966	24	31	21	S. Trout Creek	M-8	Branch	1968	Dissection	Yes	6.0
1966	23	30	30	Beaver Creek	M-9	Branch	1967	Dissection	No	
							1968	Dissection	No	
1966	21	30	1	West of Thompson Falls	M-10	Branch	1967	Dissection	No	
							1968	Dissection	No	
1966	19	32	12	Rainy Creek, Taft	M-4	Branch	1968	Dissection	No	
1966	19	30	22	Savenac Nursery	M-13	Branch	1967	Dissection	Yes	1.0
							1968	Dissection	No	

*All range numbers in Montana are west.

MONTANA

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1966	18	29	14	Drexel	M-12	Branch	1968	Dissection	Yes	38.0
							1970	Rearing	Yes	0.7
1966	18	27	31	St. Regis	M-11	Branch	1967	Dissection	Yes	3.0
							1968	Dissection	No	
1966	16	26	3	Superior	M-14	Branch	1968	Dissection	No	
1967	33	34	21	Leonia Rd.	M-4	Branch	1972	Rearing	No	
1967	32	34	22-27	North of Troy	M-5	Branch	1970	Rearing	Yes	0.3
1967	31	33	33	Savage Lake	M-6	Branch	1972	Rearing	Yes	9.0
1967	31	3	2	Doak Creek	M-7	Branch	1968	Dissection	No	
							1970	Rearing	Yes	0.3
1967	31	30	21	Rainy Creek	M-8	Branch	1970	Rearing	Yes	30.0
1967	31	26	33	Fairview R. S.	M-11	Branch				
1967	29	31	27	Cherry Creek	M-15	Branch	1968	Dissection	Yes	14.0
1967	28	30	5	Crazy Man Creek	M-9	Branch				
1967	28	29	24	Wolf Creek Road	M-10	Branch				
1967	28	24	23	Ashley Lake #1	M-16	Branch				

MONTANA

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1967	27	29	31	West Fisher	M-12	Branch				
1967	27	28	9	Loon Lake	M-14	Branch				
1967	27	21	28	Bohn Creek Rd.	M-17	Branch				
1967	26	24	16	Little Bitterroot R.	M-20	Branch				
1967	26	21	9	Stoner Creek	M-18	Branch				
1967	26	29	5	Raven R.S. Waylete	M-13	Branch	1968	Dissection	Yes	10.0
1967	25	26	4	Thompson River	M-27	Branch	1968	Dissection	No	
1967	25	24	5	Hubbart Reservoir	M-21	Branch				
1967	25	22	24	Camp Tuffit	M-19	Branch	1968	Dissection	No	
1967	23	21	12	Polson	M-36A	Branch	1968	Dissection	No	
1967	22	30	24	Belknap	M-28	Branch				
1967	22	28	33	Lower Thompson River	M-25	Branch				
1967	21	30	14	Thompson Falls Prospect Cr.	M-26	Branch	1968		No	
1967	21	29	24	Thompson Falls Cherry Cr.	M-24	Branch				

MONTANA

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1967	21	25	1	Hot Springs	M-22	Branch				
1967	20	25	24	Camas Cr.Rainbow Lake	M-29	Branch				
1967	19	26	15	Plains Combpest Cr.	M-23	Branch	1968		No	
1967	19	25	11	Paradise	M-30	Branch				
1967	18	28	15	St. Regis	M-57	Branch				
1967	18	28	33	Little Joe Creek	M-62	Branch				
1967	18	26	9	St. Regis Cutoff	M-30	Branch				
1967	18	23	23	Magpie Creek	M-31	Branch	1968	Dissection	Yes	1.0
1967	17	26	9	Pardee Creek,Superior	M-31A	Branch				
1967	17	24	25	Blue Ridge Rd.Nine-mile	M-39	Branch	1970	Rearing	No	
1967	17	22	9	Dixon	M-32	Branch	1968	Dissection	No	
1967	17	18	6	St. Mary's Lake	M-3	Branch				
1967	17	18	31	Lower Jocko River	M-34	Branch				
1967	16	27	22	Cedar Cr. Superior	M-40A	Branch				

MONTANA

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1967	16	25	22-26	Deep Creek Lozeau	M-38	Branch				
1967	16	20	9	Arlee	M-33	Branch	1968		Yes	5.0
1967	15	25	7	Sunrise Cr.Rd. Lozeau	M-40	Branch				
1967	15	24	16	Nemote Cr. Tarkio	M-37	Branch				
1967	15	23	4	Cedar Creek Ninemile	M-59	Branch				
1967	15	22	29	Ellis Creek Ninemile	M-58	Branch	1968	Dissection	No	
1967	15	22	14	Sixmile Creek	M-36	Branch				
1967	15	20	1	Evaro #1	M-35	Branch	1968	Dissection	No	
1967	15	20	12	Evaro #2 Railroad Cr.	M-61	Branch	1968	Dissection	Yes	3.0
							1970	Rearing	Yes	0.7
							1972	Rearing	Yes	
1967	14	27	11	Trout Cr. Superior	M-54	Branch	1968	Dissection	No	
1967	14	23	8	Sawmill Gulch Alberton	M-42	Branch				
1967	14	22	7	Petty Creek Alberton	M-43	Branch	1968	Dissection	No	
1967	13	24	30	South Fork Fish Creek	M-41	Branch				

MONTANA

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1967	13	21	4	Deep Cr. West of Missoula	M-44	Branch				
1968	34	33	36	Seventeen Mile Cr. Yaak R.	M-94	Branch				
1968	34	34	32	Curley Cr. Stateline Hwy 2	M-97	Branch	1970	Rearing	No	
							1971	Rearing	No	
1968	33	34	10	Pine Cr. Yaak River	M-96	Branch				
1968	33	33	19	Tepee Mountain	M-93	Branch	1971	Rearing	Yes	1.0
1968	33	33	8	Yaak Falls	M-95	Branch				
1968	33	33	33	Kilbrenan Lake	M-92	Branch	1970	Rearing	No	
							1971	Rearing	No	
1968	32	34	9	Yaak R. Bridge Hwy 2	M-90	Branch	1970	Rearing	No	
							1971	Rearing	No	
1968	32	34	25	Rabbit Creek Troy	M-89	Branch	1970	Rearing	No	
							1971	Rearing	No	

MONTANA

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1968	32	33	3	Studebaker Draw, Troy	M-91	Branch				
1968	32	33	32	Lynx Creek, Troy	M-88	Branch	1970	Rearing	No	
							1971	Rearing	No	
1968	32	31	32	Bobtail Cr.#2, Libby	M-82	Branch				
1968	32	31	26	Pipe Creek Road	M-81	Branch				
1968	32	29	22	Barron Cr. Hwy 37, Eureka	M-74	Branch				
1968	31	33	29	Lake Creek	M-87	Branch	1970	Rearing	No	
							1971	Rearing	No	
1968	31	33	14	Antlers, U.S. Hwy 2	M-86	Branch	1971	Rearing	No	
1968	31	32	16	Kootenai Falls	M-85	Branch	1970	Rearing	No	
1968	31	32	24	Quartz Cr. Kootenai R.	M-84	Branch	1971	Rearing	No	
1968	31	31	17	Bobtail Creek #1	M-83	Branch	1970	Rearing	No	
							1971	Rearing	No	
1968	31	31	22	Mickales Drawpipe Co.	M-79	Branch				
1968	31	31	34	Libby Ranger Station	M-80	Branch	1970	Rearing	No	
1968	31	31	36	Southeast of Libby	M-67	Branch				

MONTANA

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1968	31	29	32	Alexander Cr.Rd.Libby Dam	M-76	Branch				
1968	31	29	21	Alexander Mt. Libby Dam	M-75	Branch				
1968	31	29	25	Canyon Creek	M-72	Branch				
1968	30	31	2	Libby City Limits	M-78	Branch				
1968	30	31	24	Swede Mt. S. of Libby	M-68	Branch				
1968	30	30	5	Ripley, Libby	M-66	Branch				
1968	30	29	11	Dunn Cr. near Libby Dam	M-73	Branch				
1968	30	20	33	Deer Park #1, Kalispell	M-33	Branch				
1968	30	20	35	Deer Park #2	M-32	Branch				
1968	29	30	7	Swamp Cr. SE Libby	M-69	Branch				
1968	29	30	19-20	Libby Cr. #2	M-70	Branch				
1968	29	29	25	Wolf Creek #1	M-57	Branch				

MONTANA

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1968	29	28	20	Wolf Creek #2	M-65	Branch				
1968	29	28	24	Wolf Creek #3	M-58	Branch				
1968	29	28	34 35	Wolf Mountain	M-64	Branch				
1968	29	27	16	Kavalla Forks	M-59	Branch				
1968	29	26	17	Island Lake #2	M-63	Branch				
1968	29	26	31	Island Lake #1	M-62	Branch				
1968	29	20	26	Lake Blaine	M-31	Branch				
1968	28	26	24	Dahl Lake	M-61	Branch				
1968	28	24	12	Upper Ashley Lake	M-39	Branch				
1968	28	24	22	Ashley Lake #2	M-43	Branch				
1968	28	24	23	Ashley Lake #3	M-44	Branch				
1968	28	23	30	Ashley Creek School	M-45	Branch				
1968	28	23	9	Betavia School #4	M-42	Branch				
1968	28	23	10	Betavia School #3	M-41	Branch				

MONTANA

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1968	28	23	13	E. of Betavia School		Branch				
1968	28	23	24	Betavia School #2	M-40	Branch	1971	Rearing	No	
1968	28	22	19	Betavia School #1	M-54	Branch				
1968	28	22	15	West of Kalispell	M-55	Branch				
1968	28	22	23	Foy Lakes North Side	M-34	Branch				
1968	28	22	26	Foy Lakes South Side	M-51	Branch				
1968	28	19	17	Olson Creek	M-30	Branch				
1968	28	19	21-22 28-27	NE of Echo Lake	M-29	Branch				
1968	27	29	7	Spring Cr.Old Fisher Rd.	M-56	Branch				
1968	27	29	30	Miller Creek	M-71	Branch				
1968	27	24	9	Marion	M-47	Branch				
1968	27	24	21	Little Bitterroot Lake	M-46	Branch				
1968	27	23	17	Jct.Ashley Lake Rd. Hwy 2	M-48	Branch				

MONTANA

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1968	27	23	13	Jct. Ashley Lake Rd. Hwy 2		Branch				
1968	27	23	30	Lake Rogers	M-53	Branch				
1968	27	23	29	Lake Rogers #1	M-49	Branch				
1968	27	23	29	Lake Rogers #2	M-52	Branch				
1968	27	21	7	Mike Day Kalispell	M-35	Branch	1971	Rearing	No	
1968	27	19	3	Echo Lake	M-28	Branch				
1968	27	19	32	Swan River	M-5	Branch	1971	Rearing	No	
1968	27	19	23-24 25-26	Wolf Creek	M-27	Branch				
1968	26	19	7	Near Long Beach	M-26	Branch				
1968	26	19	11	Quintonkin Creek	M-25	Branch				
1968	25	22	13	Lake Mary Ronan	M-36	Branch				
1968	25	20	19	Rollins	M-37	Branch				
1968	25	20	5	Table Bay		Branch				

MONTANA

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1968	25	19	8	Bear Dance Campground	M-23	Branch	1971	Rearing	No	
1968	25	18	12	Groom Cr. Swan Lake	M-24	Branch				
1968	24	19	3	Yellow Bay	M-22	Branch	1970	Rearing	No	
							1971	Rearing	No	
1968	24	19	22	Blue Bay	M-21	Branch				
1968	24	19	34	Skidoo Bay Pine Glenn	M-20	Branch	1971	Rearing	No	
1968	23	21	1-2	Big Arm	M-38	Branch				
1968	23	19	15	Skidoo Bay	M-19	Branch	1971	Rearing	No	
1968	23	19	18	Finley Point	M-17	Branch				
1968	23	19	33	Finley Point Store	M-18	Branch				
1968	22	19	4	Ducharme Creek	M-4	Branch				
1968	22	19	28	Mud Creek near Pablo	M-16	Branch				
1968	21	19	4-5	Pablo Mud Creek	M-15	Branch				
1968	21	19	33-29	Crow Creek near Ronan	M-14	Branch				
1968	19	19	3	McDonald Lake	M-13	Branch				

MONTANA

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1968	18	28	5	Camels Hump		Pupae				
1968	18	27	3	Clark Fork Cutoff Seven Mile		Branch				
1968	18	27	9	Tamarack Creek		Pupae				
1968	18	19	11	Mission Reservoir	M-12	Branch	1971	Rearing	No	
1968	17	18	31	Jocko River #2	M-9	Branch				
1968	17	18	36	South Fork Jocko River	M-10	Branch				
1968	17	17	19	Seeley Lk.Rd. Jocko R.	M-11	Branch				
1968	17	25	22	Camp Cr. (Caged)		Special Branch	1968	Dissection	Yes	
							1970	Rearing	Yes	0.3
1968	16	23	17	Josephine Cr.Ninemile	M-3	Branch	1970	Rearing	No	
1968	16	23	13	Kennedy Creek	M-A	Branch				
1968	16	19	19	Finley Cr. Arlee	M-2	Branch				
1968	15	20	18	Mill Cr.	M-1	Branch				
1968	15	20	34	Evaro Grade	M-7	Branch				

MONTANA

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1968	15	19	6	Scheley Cr. Evaro	M-8	Branch				
1968	14	19	17	Butler Creek	M-6	Branch				
1968	14	19	35	Rattlesnake Cr.	M-13	Branch				
1969	36	33	34	Spread Cr. Yaak R.	M-2	Branch				
1969	36	32	29	Pete Creek Rd.Yaak R.	M-63	Branch				
1969	35	33	19	Meadow Cr. Yaak R.	M-61	Branch				
1969	35	33	30-29 31-32	Sylvanite R. Sta.	M-60	Branch				
1969	33	31	21	East Fork Pipe Creek	M-59	Branch				
1969	32	31	4	Canie Creek Pipe Cr.	M-58	Branch				
1969	32	23	21	Stillwater Lake	M-50	Branch				
1969	32	22	32	No.side Whitefish Lk.	M-48	Branch	1972	Rearing	No	
1969	31	23	24	Spencer Lake U.S. 93	M-49	Branch	1972	Rearing	Yes	1.0
1969	31	22	14	Big Mountain Rd.	M-47	Branch	1972	Rearing	No	
1969	31	21	27	NE of Whitefish	M-46	Branch	1972	Rearing	Yes	41.0

MONTANA

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1969	31	21	16	North F.Flathead R.Rd.	M-52	Branch				
1969	31	19	28	Coram	M-54	Branch	1972	Rearing	No	
1969	30	22	20	Tally Lake	M-43	Branch				
1969	30	22	12	South of Whitefish	M-45	Branch				
1969	30	21	32	North of Kalispell	M-44	Branch	1972	Rearing	Yes	3.0
1969	30	21	14	2 mi.W.Columbia Falls	M-51	Branch	1972	Rearing	No	
1969	30	20	12	Columbia Falls Hwy 2	M-53	Branch	1972	Rearing	Yes	1.0
1969	30	19	9	Lion Lake H.H. Dam	M-55	Branch	1972	Rearing	Yes	38.0
1969	30	18	20	North Side Hungry Horse Res	M-57	Branch				
1969	29	23	14	Rohdes Draw Kalispell Area	M-42	Branch				
1969	29	22	32	Kalispell Whitefish Area	M-41	Branch	1972	Rearing	No	
1969	29	19	2	Hungry Horse Dam	M-56	Branch				
1969	27	20	24	Bigfork		Branch				

MONTANA

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1969	25	18	25	Swan Lake Guard Sta.	M-40	Branch	1972	Rearing	Yes	33.0
1969	24	17	32	Soup Creek	M-39	Branch	1972	Rearing	No	
1969	23	17	19	Goat Creek	M-38	Branch				
1969	21	30	1	Piper Creek Swan	M-37	Branch				
1969	17	18	25	Seeley Lake Rd.	M-36	Branch				
1969	17	17	28	Jocko Lakes	M-35	Branch				
1969	15	22	36	Corral Cr. Huson	M-30	Branch				
1969	15	20	1	Evaro Dump		Pupae	1970	Rearing	Yes	
							1971	Rearing	Yes	
1969	14	23	35	West F. Petty Creek	M-25	Branch				
1969	14	21	20	Rock Cr. Pulp Mill	M-29	Branch				
1969	14	19	27	Sawmill Gulch Rattle-snake	M-34	Branch				
1969	13	24	7	South F. Fish Creek	M-21	Branch				
1969	13	22	30	Mike Cr.Petty Mt.Road	M-24	Branch				

MONTANA

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1969	13	21	12	Sherman Gulch	M-28	Branch				
1969	13	18	13	Bonner	M-33	Branch				
1969	13	18	33	East Missoula	M-93	Branch				
1969	13	17	10	Blackfoot River	M-94	Branch				
1969	12	24	26	Lolo Springs Fish Cr. Rd.	M-20	Branch				
1969	12	23	25	Lolo Work Center	M-22	Branch				
1969	12	22	6	Graves Cr.Petty Cr.Rd	M-23	Branch				
1969	12	20	4	Blue Mountain	M-27	Branch				
1969	12	19	1	Pattee Canyon	M-32	Branch				
1969	11	23	6	Granite Cr.Lolo Hot Springs	M-19	Branch				
1969	11	21	3	Mill Creek Hwy 12	M-26	Branch				
1969	11	18	17	Miller Creek	M-31	Branch				

OREGON

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1971	1N	35E	20	Emigrant Springs	0-1	Live Adult	1972	Dissection	Yes	70.0

WASHINGTON

Agathis pumila release sites							Recovery information			
Year of release	T.	* R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1966	34	44	7	Locke Pendoreille R.	W-3	Branch	1967	Dissection	Yes	3.0
							1968	Dissection	Yes	32.0
							1971	Rearing	Yes	
1966	32	41	3	Chewelah Ski Area	W-2	Branch	1968	Dissection	No	
							1970	Rearing	No	
1966	31	41	12	Cottonwood Creek	W-1	Branch	1968	Dissection	No	
							1970	Rearing	No	
1966	31	45	9	Newport Saddle Mtn	Plot 1	Branch				
1966	30	44	16	Diamond Lake	Plot 2	Branch	1970	Rearing	No	
1966	30	42	9	Blue Grouse Mtn	Plot 3	Branch				
1966	30	42	35	Eloika Lake	Plot 4	Branch				
1966	29	41	16	Loon Lake	Plot 5	Branch				
1966	28	45	28	Mt. Spokane No. 1	Plot 6	Branch				
1966	28	45	10	Blister Rust Camp	Plot 7	Branch				
1966	31	36	32	Falls Creek	Plot 8	Branch	1967	Dissection	Yes	Less than 1.
							1970	Rearing	Yes	Less than 1.
1967	40	39	23	Sheep Creek	W-2	Branch	1970	Rearing	Yes	1.3

*All range numbers in Washington are east.

WASHINGTON

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1967	37	41	5	Meadow Creek	W-1	Branch				
1967	32	39	21	Blue Creek	W-3	Branch				
1967	32	36	8	Inchelium Tree Farm	W-4	Branch	1968	Dissection	No	
							1970	Rearing	Yes	Less than 1.
							1971	Dissection	Yes	1.6
1967	30	34	24	Ried Lander Meadows	W-5	Branch				
1967	30	38	25	Springdale to Hunter Rd.	W-7	Branch				
1967	28	39	6	Wellpinit SW of Springdale	W-6	Branch				
1967	24	45	16	Mica Peak	W-8	Branch	1968	Dissection	Yes	12.0
1968	28	45	28	Mt. Spokane #2	W-1	Branch				
1968	29	38	9	Blue Mtn	W-2	Branch				
1968	30	39	14	Haviland Mdw	W-3	Branch				
1968	32	44	14	Furport	W-4	Branch	1970	Rearing	No	
1968	32	44	28	Dalkena	W-5	Branch	1970	Rearing	Yes	Less than 1.

WASHINGTON

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1969	36	28	36	Chewiliken Creek	W-1	Branch				
1969	38	30	31	Lightning Creek	W-2	Branch				
1969	35	30	11	Bailey Basin	W-3	Branch	1970	Rearing	Yes	Less than 1.
1969	35	31	23	W. Fk. Sanpoil	W-4	Branch				
1969	33	25	18	Loup Loop	W-5	Branch	1970	Rearing	Yes	Less than 1.
1969	36	24	24	Salmon Creek	W-6	Branch				
1969	40	37	7	Orient Deep Creek	W-66	Branch	1971	Rearing	No	
1969	40	37	34	Orient Cummins Rd.	W-64	Branch	1971	Rearing	No	
1969	40	37	9	Orient Camp Creek	W-65	Branch				
1969	39	36	10	Orient Work Center	W-67	Branch	1971	Rearing	No	
1969	39	36	36	Boyds	W-68	Branch	1971	Rearing	Yes	
1969	39	33	18	Curlew Kettle River	W-79	Branch				
1969	39	34	8	Curlew West Deer Cr. Rd.	W-78	Branch				
1969	36	37	28	Kettle Falls	W-70	Branch	1971	Rearing	No	

Inchelium

WASHINGTON

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1969	36	36	36	Kettle Falls #1	W-71	Branch	1971	Rearing	No	
1969	36	36	29	Kettle Falls #2	W-72	Branch	1971	Rearing	No	
1969	36	35	15	Kettle Falls Graves Rd.	W-73	Branch	1971	Rearing	No	
1969	36	33	32	Republic Hall Cr.Rd.2	W-85	Branch				
1969	36	32	3	Republic Swan Lake Swamp Cr.Rd.	W-83	Branch				
1969	36	33	26	Republic Hall Cr.Rd.1	W-74	Branch				
1969	34	32	35	Sanpoil R. Twenty-one Mile Cr.#1	W-88	Branch				
1969	34	32	15	Sanpoil R. Gold Creek	W-87	Branch				
1969	34	32	8	Sanpoil R. West Fork Indian Sta.	W-86	Branch				
1969	33	32	26	Sanpoil R. Twenty-one Mile Cr.#2	W-89	Branch				
1969	32	33	10	Sanpoil R. Thirty Mile Rd.	W-90	Branch				

WASHINGTON

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1969	32	33	34	Sanpoil R.Bridge Cr. Rd.#1	W-91	Branch				
1969	32	34	27	Sanpoil R.Bridge Cr. Rd.#2	W-92	Branch				
1969	39	33	27	Curlew Franson Park Rd.	W-7	Branch				
1969	38	31	10	Republic Old Torado	W-80	Branch	1971	Rearing	No	
1969	38	34	6	Republic Oeneas Cr.Rd.	W-76	Branch				
1969	37	33	34	Republic N.F.Sanpoil River	W-75	Branch				
1969	37	31	7	Republic Waconda Jct.	W-81	Branch				
1969	37	31	26	Republic Okanagen N.F. sign	W-82	Branch				
1969	37	32	10	Republic Swamp Creek	W-84	Branch				
1969	37	37	27	Kettle Falls Kam Loop	W-69	Branch	1971	Rearing	No	
1971	9	42	24	Charlie Creek	W-1	Live Adult	1972	Dissection	No	

BRITISH COLUMBIA

Agathis pumila release sites							Recovery information			
Year of release	T.	R.	Sec.	Area	Ident. No.	Method	Year sampled	Method	A. pumila recovered	Percent parasitism by A. pumila
1969				Fruitvale		Branch	1970	Rearing	No	
							1971	Rearing	Yes	0.5
							1972	Rearing	Yes	3.5
							1973	Rearing	Yes	30.0
1969				East Arrow		Branch	1970	Rearing	No	
							1971	Rearing	No	
							1972	Rearing	Yes	0.1
							1973	Rearing	Yes	6.0